SENATE JUDICIARY COMMITTEE

HEARING ON HUMAN CLONING

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Chair, The Joint Steering Committee for Public Policy

Thank you, Mr. Chairman, for inviting me to testify today.

I am Harold Varmus, President of the Memorial Sloan-Kettering Cancer Center in New York. Before assuming my current position in 2000, I served as Director of the National Institutes of Health for six years. I am also the Chair of the Joint Steering Committee for Public Policy, a coalition of nonprofit scientific societies representing 50,000 biomedical research scientists. In 1989, when I was on the faculty of the medical school at the University of California, San Francisco, I shared the Nobel Prize in Medicine for the discovery of cancer genes called oncogenes.

We are here today to discuss the contentious issues raised by the possibilities of human cloning. Two bills now before the Senate seek to insure that the nation behaves in an ethically appropriate manner in this new arena. Both bills would ban efforts to create cloned human beings, an appropriate prohibition given the unsafe nature of the procedure. However, one bill, by Senator Brownback and his colleagues, would set an unfortunate precedent: it would criminalize scientists, doctors, and patients who pursue the benefits of some parts of the technology involved in cloning, even if these steps were taken without any intention of making a cloned human being. The other bill, by you, Mr. Chairman, and your colleagues, would allow those benefits to be pursued, under the kinds of regulatory guidelines that have worked well for medical science in the past.

A brief science lesson: IVF versus cloning

Before returning to the legislation, let me briefly outline the science involved. It is useful to set the stage with the well-known and widely practiced procedure, in vitro fertilization (IVF; see Figure 1). In IVF, as in normal human reproduction, a single sperm fuses with (fertilizes) an egg, forming a cell that divides several times to produce an early embryo (called a blastocyst) in which cells are disordered and lack characteristics of specific organs or tissues. If the blastocyst is mechanically transferred into a uterus, a pregnancy may result; after a complex process of development, a child may ultimately be born. If, instead of implanting the blastocyst, its immature cells are dispersed and grown in a culture dish, they can continue to divide and can develop into a variety of tissue types under appropriate conditions. These so-called embryonic stem cells, the valuable by-products of IVF, have enormous potential to reveal fundamental truths about early human development, to assist drug development, and to be used as medical therapies for a wide range of human disorders.

Fortunately for the hundreds of thousands of families that now include children born as a result of IVF, this procedure was not banned or criminalized when introduced in the late 1970's, even though it was clear that many blastocysts would remain unused and eventually be discarded. Likewise, embryonic stem cells can be derived from blastocysts, without imposition of criminal penalties, as long as Federal funds are not used; some existing stem cells can even be studied with Federal funds with regulatory oversight.

Unlike IVF, which begins with the union of egg and sperm, cloning begins with the transfer of an intact nucleus from any cell in a single individual to an egg from which the nucleus has been removed (see Figure 2). In other words, it is an asexual process with all the genetic information in the progeny cell coming from one rather than two individuals. As experiments with many species of animal have shown, this procedure can, surprisingly, generate a blastocyst similar or identical to the one produced by fertilization. If the unfertilized blastocyst were transferred to a uterus, development into an infant could occur, although (judging from animal experiments) very inefficiently and usually imperfectly. If this blastocyst is dispersed into a culture dish, embryonic stem cells can be generated, studied, and used therapeutically, as they would be after IVF, with the advantage that the cells are freely transplantable to the individual who donated the nucleus.

A comparison of the legislative proposals

The bill proposed by Senator Brownback and his colleagues---and a similar measure proposed by Representative Weldon that was recently passed in the House of Representatives---would ban <u>all of the steps</u> shown in the second chart. The bill proposed by you, Mr. Chairman, and your colleagues would selectively and judiciously ban <u>only</u> the transfer of a cloned blastocyst into the uterus. Your legislation would preserve the right of American scientists to study early development with the immature clusters of cells in the blastocysts, thereby allowing them to seek new knowledge and new therapies that might benefit our citizens and others around the world.

Why am I and many others unhappy with the Brownback and Weldon bills?

First, we are troubled by the precedent of imposing criminal penalties on scientists, doctors, and patients---even those patients who might return after treatments abroad. In the past, ethically sensitive science has been regulated by Federal guidelines (for instance, for work on recombinant DNA and gene therapy); by prohibitions on the use of Federal funds (for example, for embryo research); or by classification (as for military research). Criminalizing the science I have described is unnecessary, unjustified, and unprecedented. By imposing fines and imprisonment on those seeking knowledge to benefit society, it sends a signal that could undermine the confidence of the remarkable scientific enterprise we have built in this country.

Second, legislative solutions tend to be inflexible, so rapid changes in science make it a poor target for legislative control. The NIH and other government agencies have shown repeatedly that they are well-equipped to oversee the ethical conduct of research in a manner that is openly and swiftly responsive to new findings.

Third, advocates for the Brownback-Weldon bills have obscured the profound differences between studies of immature human cells in a culture dish and the full process required to make a cloned human being. There is no "slippery slope" here. The boundary between the two activities is broad and unambiguous. Federal rules and medical guidelines can easily delineate them. Under the bill proposed by Hatch et al, crossing that clear boundary, by trying to introduce the cells into a uterus, could lead to prosecution. And the regulatory guidelines under your bill would require responsible government oversight, informed consent by cell donors, a fourteen day limit on the growth

of early embryos, and a separation of IVF clinics from laboratories for research on nuclear transfer.

Finally, the draconian legislation proposed by Brownback, Weldon and their colleagues shows inadequate appreciation for the pace and difficulty---and for the long range promise---of science. We are just beginning to understand how a fertilized egg of any species develops into a mature organism. Embryonic stem cells derived from fertilized eggs and from nuclear transfer have enormous potential to tell us how the instructions for making an organism are laid down, how they can be reversed, and how we might reconstitute them---for example, to convert liver cells to nerve cells. If we pursue such studies, we will learn great truths, and later use those truths in ways that are now difficult to predict. And if we don't, someone else, somewhere else, surely will.

An historical perspective

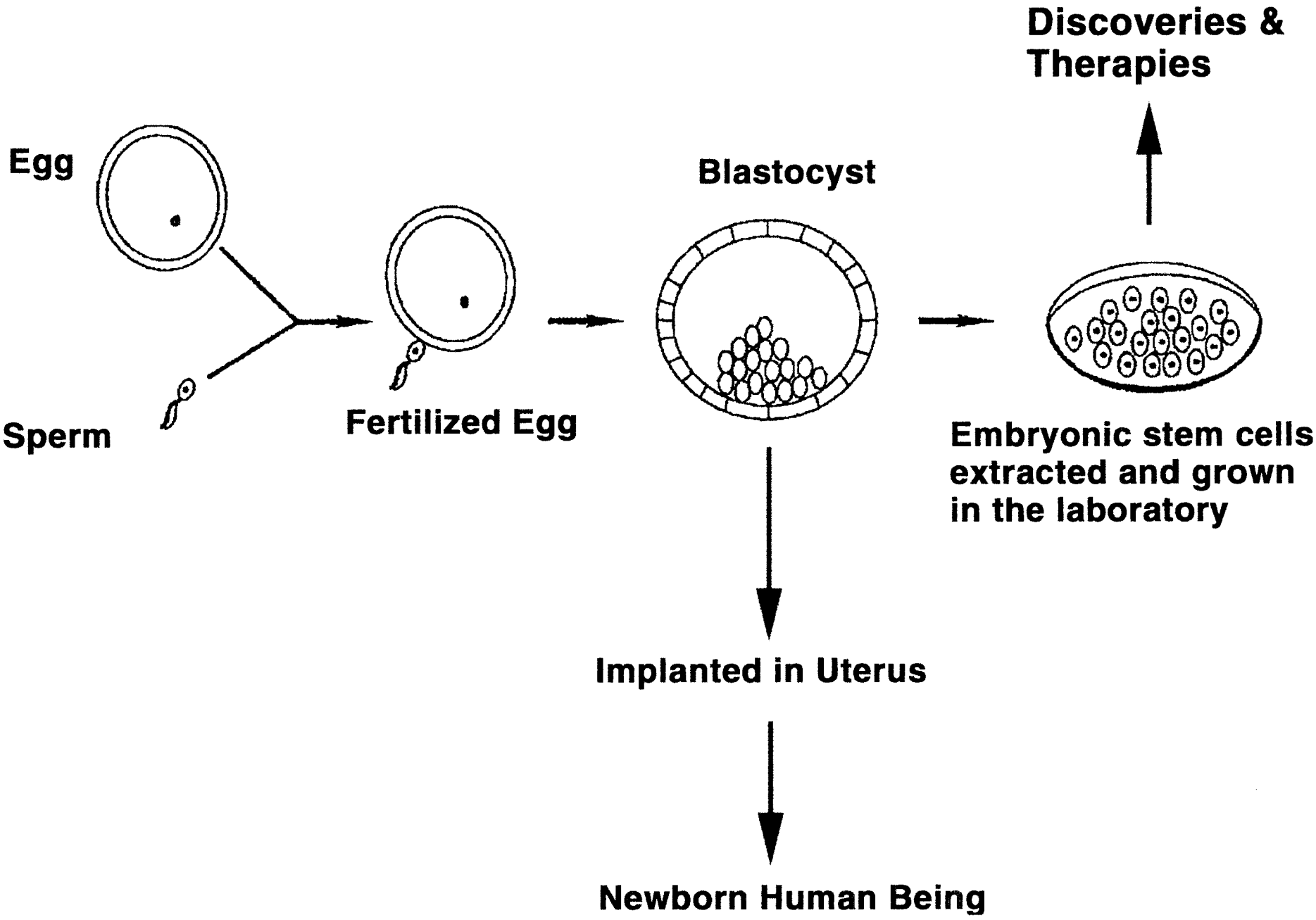
This year's 50th anniversary of the discovery of the DNA double helix provides a vantage point for this discussion. In 1953 it was evident that DNA was the embodiment of genes and that the structure of DNA was of profound significance. But it was difficult to know what might be learned by studying it. Fortunately, no one seemed to be asking whether studies of human DNA might lead to ethically unacceptable methods or outcomes. But if there had been prohibitions on the study of DNA, we might not now, fifty years later, have a vaccine for hepatitis B virus, a drug to protect the bone marrow of cancer patients, tests to alert people to their risks of certain diseases, or a powerful new way to exonerate people who have been falsely imprisoned.

Mr. Chairman, as a result of recent advances in cell biology and rapid progress on the Human Genome Project, we have now arrived at the starting line in the race to understand how cells and organs really work. The problems are immensely difficult, but the potential benefits are extraordinarily great, for those who seek to understand biology or to help the disabled.

Tshis brings me to my final plea: Why should any Member of Congress wish to punish those who wish to learn---and to treat---when we have so much more to learn? And who has such moral standing that they would impose on our multi-ethnic, pluralistic society an ethical standard that only a minority would endorse?

Thank you for an opportunity to offer my views on these important subjects; I will be pleased to answer any questions that you and your Committee members may have.

In Vitro Fertilization - Key Steps & Outcomes



Somatic Cell Nuclear Transfer - Key Steps